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Teaching Algebra to Ninth and Tenth Grade Pupils with the Use of Programmed Materials and Teaching Machines.

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In the second year of a study to compare and evaluate programed and conventional instruction in algebra for the ninth and tenth grades, comparisons of the control and experimental groups in each grade were again based on scores from the Lankton First-Year Algebra Test and the California Study Methods Survey (CSMS). Although there was a statistically significant gain in mean scores for all groups, experimental and control, from pre- to posttesting on the achievement instrument, the statistical data does not support a single definitive statement that one method of teaching is clearly superior to the other. In evaluating the programed method and materials, students noted lack of variety and need for textbook support. Ninth graders were more positive toward the programed course than tenth, a reversal of the first year experience. Teachers felt that the programed course was academically sound, but lacking in the level of difficulty or scope of a conventional course, and that such materials should be available to teachers throughout the country for use with conventional complements. It is recommended that programed materials be used to strengthen advanced curricula and to teach students with a record of absence. Further studies on programed materials in textbook form rather than teaching machine format should be conducted. Appendices of student evaluation responses and teacher logs are included. (TI)

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SIOUX FALLS PUBLIC SCHOOLS

E. W. Skarda, Superintendent

TEACHING ALGEBRA TO NINTH AND TENTH GRADE PUPILS WITH THE USE OF PROGRAMMED MATERIALS AND TEACHING MACHINES

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October 1964

Mr. Lowell Bell

Administrative Assistant to Superintendent

PREFACE

In any major undertaking many people contribute to the finished project and therefore it becomes quite impossible to acknowledge the assistance of all of those who participate. However, the following persons have contributed greatly to this research and acknowledgement of their efforts is made: Elmer Moe, teacher; Marlin Westra, teacher; R. C. McIntyre, principal of Edison Junior High School; and Ben Rossow, principal of Washington Senior High School. In addition, acknowledgement is made to Roger A. Raymond, Special Services Assistant, for writing this report and preparing the statistical analysis.

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CHAPTER I

FOREWORD

Educational innovations have increased in use throughout the United States during recent years. Many of these new educational tools have been described as highly successful in the literature. As a result, the Board of Education and Administration have initiated a research program to test some of them under local conditions.

Areas presently of considerable interest include the use of teaching machines and their related programmed materials. It was concluded, therefore, that a study of these tools would be made. More precisely, it was decided in 1962 that one phase of the research program would be an investigation of the use of machines and programmed materials in the teaching of algebra to ninth and tenth grade students. Such an investigation was conducted during the school year 1962-63. The procedures used and the data obtained are described in a report (1) prepared by the Research Division of the Sioux Falls Public Schools.

After analyzing the data from the first two semesters of the study, it was recommended by the Research Division that the investigation be continued for another year throughout the school term 1963-64. The data and procedures followed during that second year of the study are, then,

the subject of this supplemental report.

Since the paper describing the first year of work is quite detailed, the present report will include only the findings of the second year and significant departures from the procedures previously described. The interested worker is referred to the report of October 1963 cited above for complete details.

CHAPTER II

DISCUSSION OF EXPERIMENTAL CONDITIONS

Recapitulation of Problem

The experimental procedure was designed to continue for a second year the investigation begun during the school term 1962-63. As was previously the case, the study was designed to investigate two methods of teaching algebra to ninth and tenth grade pupils, i.e., by what is normally considered conventional classroom methods in the local system and by the use of programmed materials and teaching machines.

EXPERIMENTAL INVESTIGATION

Design

No significant departure from the experimental design followed during the first year of the study is to be noted. The statistical tests, independent and dependent variables, were the same for both years of the study.

Method of Analysis

As during the first year of the study, the "t" test was employed as the most suitable statistic for use with the data obtained. Data tested

by this method were the same as during the first year of the study, i.e., scores from the Lankton First-Year Algebra Test, forms Am and Bm, and the scores from the California Study Methods Survey.

Testing

The control and experimental groups were administered tests at the beginning and close of the experiment in the same manner as the previous year using the same test materials. One exception is to be noted, however, in that no special I.Q. test was given as part of the pre test battery during the second year. This test was deemed to be unnecessary as it was determined from the results of the first year that the I.Q. variable need not be controlled statistically. For the purposes of analyzing the data obtained by top 25 per cent, middle 50 per cent, and lower 25 per cent grouping on the basis of I.Q. scores ,tests normally given as part of the ninth grade testing program were used instead.

Subjects

Four classes of students participated in the study, a total of 99 students. This population was broken down as follows: ninth grade control group, 26 pupils; ninth grade experimental group, 24 pupils; tenth grade control group, 25 pupils; and tenth grade experimental group, 24 pupils. It should be noted that, as during the first year of the study, the tenth grade pupils were taking algebra a year later than is the case in the local system. It should also be noted that, contrary to the procedures followed during the first year, the ninth grade students volunteered to take algebra

through the use of teaching machines and programmed materials. During the first year of the study the students in the group were assigned to the class.

Teachers

Two teachers participated in the experiment. One was from a junior high and taught one control and one experimental class at the ninth grade level. This instructor had participated in the same manner during the first year of the study. The second instructor was from the senior high school and taught one experimental and one control class at the tenth grade level. This instructor was newly assigned to the high school mathematics department and replaced the teacher who had participated during the first year of the program.

Procedure

Procedures during the second year of the study were the same as those previously followed. An exception should be noted, however, in that students in the experimental classes began using their machines and algebra programs during the first week of school. This was not the case during the first year of the study due to late delivery of the material from the publisher.

Teacher Evaulations

No change from the first year of the study is to be noted in respect to this portion of the study. The same methods and forms used during the first year were followed without change.

Student Evaluations

No change from the first year of the study is to be noted in respect to this portion of the study. The same methods and forms used during the first year were followed without change.

CHAPTER III

RESULTS

Statistical Analysis

In respect to time, both the experimental and control groups met for one class period of 50 minutes daily for the entire school year. Table I, page 8, included the number of students in the experimental groups completing each unit of programmed material. A study of the table will show that four students completed all 16 units while two proceeded no further than Unit Seven. In interpreting this latter figure it must be remembered that each student had to repeat each unit if their post unit test scores were not up to standards established by the teacher.

Table II, page 9, tabulates the "t" values that resulted from a comparison of pre and pre and post and post test scores from the Lankton First-Year Algebra Test and the California Study Methods Survey between control and experimental groups. The values of "t" obtained for both the pre and post tests between the ninth grade control and experimental groups, and the tenth grade pre tests were not found significant. In this instance, the null hypothesis, i.e., there is no difference between test means for these groups, is found tenable. For tenth grade students the comparison

TABLE I

NUMBER OF STUDENTS IN EXPERIMENTAL GROUPS
COMPLETING VARIOUS NUMBERS OF UNITS

GRADE	5	6	7	8	9	10	11	12	13	14	15	16
9	1	2	2	1	2	2	8	1	1	2	0	2
10	1	3	4	2	4	4	4	3	0	0	1	2
TOTAL 9 & 10	2	5	6	3	6	6	12	4	1	2	1	4

TABLE II

A COMPARISON OF PRE AND PRE AND POST AND POST TEST SCORES ON THE LANKTON FIRST-YEAR ALGEBRA TEST AND THE CALIFORNIA STUDY METHODS SURVEY BETWEEN EXPERIMENTAL AND CONTROL GROUPS

Test	Control N	Experimental N	Control Mean	Experimental Mean	"t"	Probability	Control N	Experimental N	Control Mean	Experimental Mean	"t"	Probability
Lankton			94.00									
Pre	26	24	94.00	97.50	1.2727	n.s.	25	24	93.12	89.33	1.8309	n.s.
Post	26	24	115.73	117.83	.6563	n.s.	25	24	107.64	99.67	2.8262	>.01
Calif. A												
Pre	26	24	30.92	35.71	1.3764	n.s.	25	24	28.36	29.75	.6318	n.s.
Post	26	24	29.88	33.54	1.8866	n.s.	25	24	27.12	27.75	.2727	n.s.
Calif. B												
Pre	26	24	40.88	43.33	1.7883	n.s.	25	24	37.88	35.13	1.4865	n.s.
Post	26	24	40.31	43.29	1.7844	n.s.	25	24	38.08	34.54	1.3258	n.s.
Calif. C												
Pre	26	24	17.38	21.83	4.0090	>001	25	24	17.96	17.46	.3972	n.s.
Post	26	24	15.23	19.04	2.7810	>.05	25	24	15.84	15.21	.4468	n.s.
Calif. T												
Pre	26	24	89.15	100.88	3.4807	>.01	25	24	84.20	79.08	.8935	n.s.
Post	26	24	85.42	95.46	2.3134	>.05	25	24	81.04	77.50	.6519	n.s.
Calif. VF												
Pre	26	24	24.65	25.58	1.4308	n.s.	25	24	25.72	24.38	1.4255	n.s.
Post	26	24	25.54	26.58	1.3000	n.s.	25	24	25.12	24.29	1.1216	n.s.

of the experimental and control groups on their post test was found to be significant at the 1.0 per cent level of confidence and beyond. In this case the null hypothesis is rejected: there is a significant difference between the means on the post test for these two groups.

Further consideration of Table II will show that no significant values of "t" were found for either the ninth or tenth grade group on Part A, Part B, and Part VF of the California Study Methods Survey. Therefore, the null hypothesis, i.e., no difference between groups exists as measured by these portions of the California test, is found tenable. In the case of Part C and total score on the California test as used with the ninth grade students, significant values of "t" were found for both the pre and post test comparisons. A study of the table will show that the mean values indicate the direction of significance to be in favor of the experimental group in all four cases. The null hypothesis, i.e., there is no difference between groups, is rejected.

Table III and Table IV, pages 11 and 12, provide the mean scores and standard deviations from the pre and post Lankton and California tests. These data are provided in the form of values for the top 25 per cent, middle 50 per cent, and lower 25 per cent as well as values for the total group in each instance. Table V, page 13, tabulates the "t" values and probabilities for the differences in means for test sessions. Table VI, page 14, provides the per cent of increase for the mean scores from the Lankton First-Year Algebra Test.

TABLE III

A COMPARISON OF PRE AND POST TEST MEAN SCORES IN THE LANKTON FIRST-YEAR ALGEBRA TEST AND THE CALIFORNIA STUDY METHODS SURVEY

	GRADE	Level of Group (by intelligence) 1. Top 25% 2. Middle 50% 3. Lower 25%	SUBJECTS	Lankton		California A		California B		California C		California T		California VF	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
EXPERIMENTAL	9	1	6	100.50	130.67	33.67	34.50	43.17	44.50	21.00	18.33	97.83	97.33	24.83	26.00
		2	12	96.50	112.92	36.83	33.92	43.33	43.75	22.25	19.58	102.42	97.25	25.92	27.25
		3	6	96.50	114.83	35.50	31.83	43.50	41.17	21.83	18.67	100.83	90.00	25.67	25.83
		Total	24	97.50	117.83	35.71	33.54	43.33	43.29	21.83	19.04	100.88	95.46	25.58	26.58
	10	1	6	88.50	100.83	35.67	33.83	37.33	37.67	21.17	17.67	94.17	89.17	25.00	26.33
		2	12	88.00	97.92	29.33	27.75	35.42	34.17	16.92	15.00	81.25	76.92	24.92	24.17
		3	6	92.83	102.00	24.67	21.67	32.33	32.17	14.83	13.17	59.67	67.00	22.67	22.50
		Total	24	89.33	99.67	29.75	27.75	35.13	34.54	17.46	15.21	79.08	77.50	24.38	24.29
CONTROL	9	1	7	98.86	122.14	31.71	29.57	42.71	41.14	15.71	13.71	90.14	84.43	25.71	25.71
		2	12	95.08	115.17	30.33	29.75	41.33	41.83	18.33	16.42	89.92	88.00	23.83	25.67
		3	7	87.29	110.29	31.14	30.43	38.29	36.86	17.43	14.71	86.86	82.00	25.00	25.14
		Total	26	94.00	115.73	30.92	29.88	40.88	40.31	17.38	15.23	89.15	85.42	24.65	25.54
	10	1	6	96.67	112.67	30.00	26.17	42.83	40.33	19.00	15.17	91.83	81.67	27.50	27.00
		2	12	92.08	105.50	29.17	26.08	37.50	37.50	16.92	15.17	83.58	78.75	26.00	24.67
		3	7	91.86	107.00	25.57	29.71	34.29	37.14	18.86	17.57	78.71	84.43	23.71	24.29
		Total	25	93.12	107.64	28.36	27.12	37.88	38.08	17.96	15.84	84.20	81.04	25.72	25.12

TABLE IV

A COMPARISON OF PRE AND POST TEST STANDARD DEVIATIONS ON THE LANKTON FIRST-YEAR ALGEBRA TEST AND THE CALIFORNIA STUDY METHODS SURVEY

	GRADE	Level of Group (by intelligence) 1. Top 25% 2. Middle 50% 3. Lower 25%	SUBJECTS	Lankton		California A		California B		California C		California T		California VF	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
EXPERIMENTAL	9	1	6	5.56	10.66	9.76	7.54	3.58	2.06	3.56	4.53	14.07	13.17	2.55	1.83
		2	12	7.86	8.42	6.79	6.25	4.44	4.47	2.98	4.17	11.06	12.15	1.71	1.01
		3	6	10.81	10.68	5.61	7.76	3.50	6.82	5.15	5.94	11.77	18.68	1.97	3.63
		Total	24	8.42	12.16	7.36	7.06	3.99	4.93	3.81	4.79	12.19	14.64	2.06	2.26
	10	1	6	7.32	7.45	3.68	4.98	6.18	9.52	4.45	4.42	10.38	17.87	2.83	.94
		2	12	8.35	12.07	7.39	7.84	5.47	5.67	4.54	3.49	14.14	15.08	2.99	2.41
		3	6	7.27	5.80	8.17	8.36	8.30	9.67	4.98	6.91	30.63	24.32	4.61	3.09
		Total	24	8.10	9.92	7.93	8.54	6.70	8.12	5.17	5.05	22.69	20.08	3.57	2.72
CONTROL	9	1	7	7.92	7.34	7.48	4.89	6.27	5.03	4.43	4.37	15.08	12.72	1.67	1.39
		2	12	8.69	7.67	4.61	6.48	5.02	7.44	3.78	5.14	10.43	17.38	3.02	3.75
		3	7	12.39	11.25	3.36	7.09	4.13	5.00	2.50	3.45	5.44	13.32	1.20	2.36
		Total	26	10.59	9.74	5.31	6.28	5.44	6.60	3.84	4.68	11.02	15.40	2.44	2.93
	10	1	6	5.59	10.47	4.80	3.93	4.95	6.02	3.42	2.41	10.32	8.99	1.50	1.16
		2	12	5.81	8.60	6.91	7.52	6.09	8.33	4.92	4.62	16.29	19.04	2.42	2.66
		3	7	4.85	7.96	8.28	7.96	4.37	5.49	4.02	5.37	16.35	17.69	3.19	1.83
		Total	25	5.85	9.38	7.13	7.16	6.21	7.21	4.47	4.57	15.82	16.94	2.85	2.41

TABLE V

A COMPARISON OF MEAN DIFFERENCES OF PRE AND POST TEST SCORES ON THE LANKTON FIRST-YEAR ALGEBRA TEST AND THE CALIFORNIA STUDY METHODS SURVEY FOR EXPERIMENTAL AND CONTROL GROUPS

GRADE	Level of Group (by intelligence) 1. Top 25% 2. Middle 50% 3. Lower 25%	SUBJECTS	"t" Lankton	"t" Calif. A	"t" Calif. B	"t" Calif. C	"t" Calif. T	"t" Calif. VF	PROBABILITY Lankton	PROBABILITY Calif. A	PROBABILITY Calif. B	PROBABILITY Calif. C	PROBABILITY Calif. T	PROBABILITY Calif. VF
EXPERIMENTAL	1	6	8.6695	.1865	.7557	1.1266	.0712	.1619	>.001	n.s.	n.s.	n.s	n.s.	n.s.
9	2	12	6.4392	2.0138	.3784	2.2437	2.1632	2.2931	>.05	n.s.	n.s.	<.05	n.s.	<.05
	3	6	3.2385	1.5228	1.3391	1.6010	2.1574	1.6479	>.05	n.s.	n.s.	n.s.	n.s.	n.s.
	Total	24	8.7629	1.5175	.0476	3.5316	2.2213	.0000	>.001	n.s.	n.s.	<.05	<.05	n.s.
	1	6	3.5128	.7991	.1480	2.1845	1.0417	.9852	>.05	n.s.	n.s.	n.s.	n.s.	n.s.
	2	12	2.8023	.5830	.8170	1.6696	.9580	1.5417	>.05	n.s.	n.s.	n.s.	n.s.	n.s.
10	3	6	3.7500	.8571	.0825	1.0000	1.2905	.1574	>.05	n.s.	n.s.	n.s.	n.s.	n.s.
	Total	24	5.2304	1.2121	.5577	2.8125	.5249	.1600	>.001	n.s.	n.s.	<.05	n.s.	n.s.
CONTROL	1	7	13.0843	1.0094	.6826	1.3986	1.1971	.0000	>.001	n.s.	n.s.	n.s.	n.s.	n.s.
9	2	12	7.3824	.4603	.2890	1.2886	.2654	1.5913	>.001	n.s.	n.s.	n.s.	n.s.	n.s.
	3	7	13.6905	.3757	.6327	2.0224	1.1020	.1414	>.001	n.s.	n.s.	n.s.	n.s.	n.s.
	Total	26	15.4113	1.1183	.5043	2.5595	1.8306	1.5439	>.001	n.s.	n.s.	<.05	n.s.	n.s.
	1	6	3.0075	1.1171	1.2438	1.8867	2.4906	1.2195	>.05	n.s.	n.s.	n.s.	n.s.	n.s.
10	2	12	5.5000	2.3158	.0000	1.9022	1.5237	2.1452	>.001	<.05	n.s.	n.s.	n.s.	n.s.
	3	7	5.0783	2.5244	1.7546	1.1217	1.7623	.3904	>.001	n.s.	n.s.	n.s.	n.s.	n.s.
	Total	25	2.5042	2.0265	.1852	2.9041	1.3680	1.1538	>.05	n.s.	n.s.	<.05	n.s.	n.s.

(At 5 df a "t" value of 2.571 is required for p=>.05, 4.032 is required for p=>.01, and 6.859 at p=>.001. At 10 df a "t" value of 2.228 is required for p=>.05, 3.169 for p=>.01, and 4.587 at p=>.001.)

TABLE VI

PER CENT OF MEAN SCORE GAIN ON THE LANKTON TEST
FROM PRE TO POST TEST MEASUREMENT

	GRADE	Level of Group (by intelligence) 1. Top 25% 2. Middle 50% 3. Lower 25%	$\bar{X}$ Pre	$\bar{X}$ Post	Gain	Per Cent
EXPERIMENTAL	9	1	100.5	130.7	30.2	30
		2	96.5	112.9	16.4	17
		3	96.5	114.8	18.3	19
		Total	97.5	117.8	20.3	21
	10	1	88.5	100.8	12.3	14
		2	88.0	97.9	9.9	11
		3	92.8	102.0	9.2	10
		Total	89.3	99.7	10.4	12
CONTROL	9	1	98.9	122.1	23.2	23
		2	95.1	115.2	20.1	21
		3	87.3	110.3	23.0	26
		Total	94.0	115.7	21.7	23
	10	1	96.7	112.7	16.0	17
		2	92.1	105.5	13.4	15
		3	91.9	107.0	15.1	16
		Total	93.1	107.6	14.5	16

Analysis of the data contained in Table V will show that a statistically significant gain in mean scores was found for all groups on the Lankton First-Year Algebra Test. The null hypothesis, i.e., there is no difference between groups as measured by the Lankton test, is rejected in all cases at the 5.0 per cent level of confidence and beyond.

A consideration of the probability portion of Table V and the mean values tested that are shown on Table III will show that, with the exception of the VF scale as it relates to the middle 50 per cent of the ninth grade experimental group, all tests that resulted in a significant value of "t" indicate a loss of mean value from the pre to the post test. The single exception, of course, represents a gain from pre to post testing.

No positive statement as to the reason for these shifts from pre to post testing may be advanced on the basis of the limited information available. For the purposes of information, however, sub-test A of the California Study Methods Survey, measures the student's attitude toward school as it relates to his feelings of harmony with the school-community and his morale.

In sub-test B an attempt is made to measure the student's attitudes as they relate to mechanics of study. In this instance consideration is given to the student's feelings about the use of outlines in reading or note taking, memorization, reviewing for tests, differential approaches

to learning new subject matter, and techniques used for retention of various subjects.

The student's attitudes relating to planning and system are investigated in sub-test C. Here the items attempt to measure the student's feelings as they relate to his estimate of the extent to which he budgets his time and the degree of care he exercises in performing his academic tasks.

The portion of the test designated VF is the final sub-test area. This is a verification score or validity measure.

In summary, the statistical data indicate that the experimental as well as control groups at both grade levels made statistically significant gains in mean scores on the Lankton First-Year Algebra test from pre to post testing. The data also indicate that a statistically significant loss in mean values from pre to post testing occurred for the group and sub-test areas of the California Study Methods Survey as follows: Part A (Attitudes Toward School) for the middle 50 per cent of the tenth grade control group and Part C (Planning and System) for the middle 50 per cent of the ninth grade experimental group. Additionally, a loss in mean values from pre to post testing was found to be significant for the total group mean for Part C of the California test for all groups.

The single shift in mean value that represented a statistically significant gain from pre to post testing occurred in the VF score. This

gain was in the mean value for the middle 50 per cent of the ninth grade experimental group.

Student Evaluations

Students in the two experimental groups completed a questionnaire at the end of the research project in which they evaluated their work with the teaching machines and programmed materials. Answers to the first six questions asked are summarized in Table VII, page 18.

In answer to the first question: "If a program had not been used in this course..." 56 per cent of the ninth grade group felt that it would have made no difference and 68 per cent of the tenth grade students felt they would have learned more.

In answer to question two: "In comparing work done using the programs with studying in regular textbooks, I felt that, with the same amount of time and effort..." a substantial number of students, 36 per cent of the ninth grade pupils and 44 per cent of the tenth grade pupils felt they would learn more from studying textbooks. In addition 24 per cent of the tenth grade students were more positive in their response, i.e., they felt they definitely would have learned much more from studying textbooks.

Question number three: "If I were to take another course in this subject or a similar field, I would..." elicited the answer from 48 per cent of the ninth grade pupils that they would prefer having the programmed materials used for at least part of the course. Seventy two per cent of

TABLE VII

PERCENTAGE RESULTS OF STUDENTS' EVALUATION

Question	GRADE 9	GRADE 10	Total
1. If a program had not been used in this course, I believe:			
I would have learned less from the course	24	20	22
It would have made no difference	56	12	34
I would have learned more from the course	20	68	44
	(N-25)	(N-25)	(N-50)
2. In comparing work done using the program with studying in regular textbooks, I feel that, with the same amount of time and effort:			
I learn much more with the program	16	8	12
I learn somewhat more with the program	28	12	20
I feel there is no difference	20	12	16
I learn somewhat more from studying textbooks	36	44	40
I learn much more from studying textbooks	0	24	12
	(N-25)	(N-25)	(N-50)
3. If I were to take another course in this subject or a similar field, I would:			
Prefer to have programs used for at least part of the course	48	24	36
Prefer not to have programs used	32	72	52
Not care whether programs are used or not	20	4	12
	(N-25)	(N-25)	(N-50)
4. How much do you think you learned from the program?			
Learned nothing	0	0	0
Learned a little	0	20	10
Learned a medium amount	28	56	42
Learned quite a bit	64	20	42
Learned very much	8	4	6
	(N-25)	(N-25)	(N-50)
5. To what extent did you enjoy going through this program?			
Very unenjoyable	0	4	2
Unenjoyable	0	24	12
50-50	52	48	50
Enjoyable	40	16	28
Very Enjoyable	8	8	8
	(N-25)	(N-25)	(N-50)
6. To what extent was the program repetitious?			
Much too repetitious	0	4	2
Too repetitious	8	16	12
Moderately repetitious	44	36	40
Slightly repetitious	32	28	30
Not at all repetitious	16	16	16
	(N-25)	(N-25)	(N-50)

the tenth grade pupils indicated they would prefer not having the program used.

The fourth question was: "How much do you think you learned from the program?" Twenty eight per cent of the ninth graders and 56 per cent of the tenth grade group felt they had learned at least a medium amount from the programmed materials. The next step on the scale for this question, however, produced a rather pronounced difference of opinion between the groups. Sixty four per cent of the ninth graders felt they had learned quite a bit while only 20 per cent of the tenth grade pupils were of this viewpoint.

"To what extent did you enjoy going through this program?" was question number five. Fifty two per cent of the ninth grade pupils and 48 per cent of the tenth grade group had ambivalent feelings about their reaction to the question. Among the ninth grade pupils 48 per cent found the program either enjoyable or very enjoyable. This contrasted markedly with 24 per cent of the tenth grade students who answered the question in a similar fashion.

The last question: "To what extent was the program repetitious?" produced a majority reaction in both groups with 52 per cent of the ninth grade pupils and 56 per cent of the tenth of the view that the program was much too repetitious or moderately so.

Also included on the form was an open-ended question: "In your own words say what you thought of the program. For example, what did

you like about the program; what did you dislike about it; etc.?" (See Appendices A and B for a reproduction of all student responses to this item.)

The most frequent statement made by both the ninth and tenth grade groups to the open-ended question concerned their boredom with the programmed materials. Next in order of frequency was the comment made by the tenth grade pupils who felt they needed homework and a textbook. Nine tenth grade pupils commented that they would have liked to use a textbook while only one ninth grade student voiced this feeling.

To summarize, it appears that with the exception of the areas considered above the remarks of the two groups in response to this question are quite individualistic. The generalization may be made, however, that in general the ninth grade comments are more positive in nature than those of the tenth grade class. This is a reversal of opinion from the first year of the study when the remarks of the tenth grade class were basically positive with the ninth grade class comments quite negative in nature.

Teacher Evaluations

Teachers involved in the study completed an evaluation form at the end of the school year. The first question asked was: "Is the subject matter of the program academically sound?" Both teachers answered yes and appended the following comments:

> The material is sound, but I do not believe it reaches the level of difficulty attained by the contemporary course.

> The program is a little narrow -- some units need strengthening.

The second question was: "Was the level of the subject matter appropriate for your class?" Both teachers answered the question yes. Their additional comments were:

> Appropriate for the type of student who takes algebra in grade ten, but may be too easy for an average student. Definitely too easy for a good student.

> Appropriate for the majority of students. Some of the better students thought the steps too small.

Question number three was: "As contrasted with what you have been able to accomplish with other types of learning material, how much do you feel you were able to get your pupils to learn with this program?" One teacher felt that he was able to get his pupils to learn about as much as with other material. He commented that:

> The same comment as last year. The students do not have the breadth of knowledge as in a conventional course.

The other teacher felt that his students learned a little less than with most other material and commented:

> I believe this only because the program does not have as difficult and detailed problems.

The next question was: "The next time you teach a course in this subject or a similar field, would you: (a) Prefer to have programs used for at least part of the course? (b) Prefer not to have programs used? (c) Not care whether programs are used or not?" One teacher did not answer the question. The other indicated he would prefer to use the program for at

least part of the course. The comments made by the teachers were:

> I believe programmed materials can be used effectively in conjunction with textbooks.
>
> First I would get rid of the cumbersome machines and use workbook style or textbook style for the entire course.

Question number five was: "To what extent did you enjoy using this program with your class?" On a scale which ran, Very Unenjoyable, Unenjoyable, 50-50, Enjoyable, Very Enjoyable, one teacher answered Enjoyable and the other answered Very Enjoyable. One teacher made no further comment, but the other concluded:

> Having gone thru' one year -- this second year became much more enjoyable, being more familiar with the program.

The next question was: "Do you think this program should be made available for the use of teachers throughout the country?" Both teachers answered yes with the following added reactions to the question.

> I think it should be available, however, it should not be used as a sole medium.
>
> If all teachers could go thru' one programmed course they would learn a lot about presenting material in "learnable" lots.

The final question asked the teachers to summarize their opinion of the program. One teacher replied as follows:

> Strong Points:
>
> 1. The opportunity for enrichment after the course is finished. (This year sets and set notations were studied by some.)
> 2. The teacher need waste no time on discipline.
> 3. Programmed instruction is self-motivating.
> 4. The course gives you the "basic facts" of algebra rapidly so that one could go on into advanced work quickly.

Weak Points:

1. The testing part of the program needs two different tests for each unit.
2. The program is narrow in scope.
3. Students become bored with the repetitious process.
4. Review problems for students very scanty.
5. The lack of student-teacher interaction produces a dull class atmosphere.

It is my personal opinion that a program such as this offers something that is not usually found in the conventional classroom. In this type course he (the student) must produce by his own volition or nothing happens. He is put in the position where he himself makes the decision "to study or not to study". In conventional classrooms he is forced to study, so to speak. In this class he becomes the "decision maker".

The other teacher answered the final question in the following manner.

Since the tenth grade algebra students are mostly below average intellectually, I feel that this program was a good experience for them. Most of the students could understand the material and work the problems without too much difficulty. However, I wonder if the course is adequate for those who wish to take more mathematics in high school. I had a student in geometry this year who felt the programmed course he took last year was somewhat deficient. I do believe, though, that this is an efficient way to learn algebra.

It has been an enjoyable experience for me to teach this course. This method certainly necessitates a teacher keeping "on the ball", especially concerning extra individual help. Because every student is at a different place in the program, the teacher must be ready to expect all types of questions, all types of problems.

When putting away the material today, I have found that the construction and system of the materials could be improved upon. Some of the boxes are torn, sheets are torn, and some pages are missing. In a few boxes we have found entire units missing. I believe the same thing could be accomplished with programmed materials in textbook form. This would also enable the student to work at home or on his own time.

Teacher Anecdotal Records

Both teachers maintained daily anecdotal logs that related to the activities of their experimental classes. All comments recorded during the year are reproduced as Appendices C and D.

Although some difficulty with the operation of the machines was experienced, comments such as the following suggest that by the end of the first month of school, class activity had become a matter of smooth routine.

> 9/17/63 Mechanical problems have been decreased to none. The last ten minutes today were spent in reviewing how to enter items in the student log books.
>
> 9/19/63 When asked how they liked the machines most students responded favorably. Many liked the idea of no homework. Only one person, (_____), expressed boredom and would prefer conventional methods.
>
> 9/27/63 We took a major portion of the class period to discuss Unit Two. The students do not need very much help on the early units; nor do they have many question on the unit.

Boredom with the fixed routine surrounding regular use of the machines and programmed materials developed as the course progressed. The following excerpts illustrate this reaction.

> 10/21/63 Today the class shows the first sign (as a class) of being a little "edgy". It seems the first inkling of boredom is setting in.
>
> 11/14/63 Students have asked if they must take this course second semester. Some have said they liked to stay with it (the students doing better) and others would like to get out of this group. (_____) still says she "hates" this method of learning. She says she relies too much onthe answers.

1/9/64 I can detect quite a bit of boredom setting in at this point with some students. Most of them have started the second box which is considerably larger than the first one. Maybe they see only a lot more of the very same thing.

1/31/64 Found one student reading a book in class today. She is apparently quite bored with the program. When questioned she claimed she would rather be in a conventional textbook course. She went from a B to a C between the first nine weeks and the second. Maybe this shows her lack of interest. I think her ability is above average, but I haven't checked her math aptitude scores.

In spite of the foregoing, many favorable comments could be quoted regarding the use of the machines and programmed materials. The following are typical.

10/15/63 The machine teaching is very handy for people who are absent. A student had been absent for two weeks and could simply start out where he quit the last day of his attendance.

10/22/63 One student has been absent four weeks and has his machine at home.

10/23/63 At PTA last night some parents were concerned about the program. Comments such as, "Are they learning any Algebra?" and "Is this a better way to learn?" were raised. (_____) parents said he was very enthusiastic about the program. He is also doing very well.

1/20/64 Transferred a boy,(_____), from a regular class to the machines course. The reason is that he has missed 26 days out of 38 days of the quarter for illness. He's a good student but is ill a lot. I'm going to test him with the program tests to see about where he should be. This may prove to be a valuable way to help a student who has missed considerable school and where make-up work for such a long period of time becomes insurmountable. We'll see how he progresses.

2/4/64 It's interesting to note how students are reacting to this type of course. Most students, having finished a unit, immediately take the unit out of the machine and review it. Some take a period; some two periods. This they have learned without being told. They have developed some sort of initiative or motivation to study for a

test. Many students in conventional algebra do not do this -- even when told to do it.

3/11/64 I have gained a new student, (_____), who transferred into our school and started in the traditional course. After finding he was behind, he was placed in this group. I started him on the second box, so that he is still behind the rest of the group. However, I see this as an advantage of the programmed instruction.

4/7/64 (_____) is tutoring a student who cannot attend school because she is crippled. He has been using the program and a machine and says it is working quite satisfactorily. A definite advantage for this type of material.

In general the pattern of reaction shown by the daily log entries appeared to be: brief annoyance produced by difficulty with machines, followed by a growing interest by students in using the material. From this the content of the entries tends to show the interest apparently changed toward the end of the first semester to one of boredom on the part of many students as they worked daily with the programmed materials. A developing contact between teachers and students followed as supplementary materials found wider and more active use. This latter situation appeared to culminate in an awareness on the part of students that to learn they must help themselves.

Two specific recommendations made by teachers in the anecdotal records need also be mentioned. They are as follows:

10/17/63 In making a student repeat a unit test, it might be well to require that they must study the unit one full period or more before repeating the test.

5/26/64 It is a mistake to let the students progress entirely at their own rate of speed. This year I let them do that and many of them did not complete the course. One must set up some sort of a time schedule.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The purpose of this research was to continue for a second year the investigation of teaching algebra to ninth and tenth grade students through the use of teaching machines and programmed materials. The original study which the present research continues was begun in the fall of 1962.

The two schools previously selected again supplied one experimental and one control class each. Both experimental groups used programmed materials and teaching machines and both control groups used conventional methods and materials employed in teaching algebra in the local system.

A descriptive analysis of the study was made through the use of teacher and student reports and evaluations. Tests of statistical inference were made to evaluate the gain in mean scores by each group. These tests were made by total group and by ability groups as determined by intelligence test scores.

Statistical Analysis

Based on the statistical data it is not possible to make a

single definitive statement that one method of teaching is clearly superior to the other. It does appear, however, that the following conclusions may be reached.

1. There was a statistically significant gain in mean scores for all groups, both experimental and control, from pre to post testing as measured by the Lankton First-Year Algebra Test.
2. There was a significant loss in the mean score for the middle 50 per cent of the ninth grade experimental group on the Planning and System portion of the California Study Methods Survey.
3. There was a significant loss in the mean score for the middle 50 per cent of the tenth grade control group on the Attitudes Toward School portion of the California Study Methods Survey.
4. There was a significant loss in the total group mean for all groups, both experimental and control, at both grade levels in the Planning and System portion of the California Study Methods Survey.
5. There was a significant loss in the total group mean of the ninth grade experimental group on the total score for the California Study Methods Survey.
6. There were no significant changes either gain or loss for any

group either experimental or control, ninth or tenth grade, on The Mechanics of Study portion of the California Study Methods Survey.

7. There was a significant gain in the mean score for the verification portion of the California Study Methods Survey by the middle 50 per cent of the ninth grade experimental group.

Student Evaluations

Following are conclusions reached after analysis of the student evaluations of the experimental use of the programmed materials and teaching machines.

8. A plurality of students in both the ninth and tenth grade felt that the programmed materials became increasingly boring and repetitious as they progressed through the course.

9. The majority of students in the ninth grade felt it would have made no difference as to the amount they would have learned had the programmed materials not been used.

10. The majority of tenth grade students felt they would have learned more if they had not used the programmed material.

11. A plurality of students at both grade levels felt they would have learned somewhat more if they had used text books rather than programmed materials.

12. A plurality of the ninth grade students felt they would like to have the programmed materials used for at least part of

the course.

13. A majority of the tenth grade students felt they would prefer not having the programmed materials used.

14. A majority of the ninth grade students felt they learned quite a bit from the programmed material.

15. A majority of the tenth grade students felt they had learned a medium amount from the programmed materials.

16. A majority of the ninth grade students had ambivalent feelings regarding the degree to which they enjoyed using the programmed material and teaching machines.

17. A plurality of the tenth grade students felt that using the teaching machines and programmed materials was unenjoyable.

Teacher Evaluations

Following are conclusions reached after analysis of the teacher evaluations of the experimental use of the programmed materials and teaching machines.

18. Teachers felt that the subject matter of the programmed algebra course was academically sound, but that it did not reach the level of difficulty or scope of a conventional course.

19. Teachers felt that the level of the subject matter in the programmed algebra course was appropriate for their class, but that it was too easy for the better student.

20. Teachers felt that the programmed material permitted them to teach their students as much or slightly less than they would with conventional materials.
21. Despite reserved opinions as to detail both teachers felt that, in general, using the teaching machines and programmed materials was an enjoyable experience.
22. Both teachers felt that the programmed materials and machines should be available to teachers throughout the country, but that it should not be the only material used in a course.
23. Teachers felt that the use of the programmed material would be helpful in assisting a teacher to develop an understanding of what constitutes a "learnable lot" of material.
24. Teachers felt that the use of such materials and methods has special merit when dealing with students that are new to the class during the year or absent frequently.

Recommendations

As a result of the study the following recommendations are made.

1. That programmed materials be considered as a device for strengthening the curriculum, especially at advanced levels.
2. That programmed materials in specific areas be considered as a teaching tool for use with students absent for long periods.
3. That further studies of the use of programmed materials in

textbook form rather than as part of a teaching machine programmed material combination be made.

4. That research studies be continued in the school system. Research studies that are well designed and appropiately controlled provide much useful data applicable directly to local problems and conditions.

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APPENDIX

APPENDIX A

NINTH GRADE STUDENT RESPONSES TO QUESTION SIX OF THE STUDENT EVALUATION FORM

I like the program because you learn to change and correct your wrong answers right away but I need repetition and going over it or I forget how to do the problems. (sic)

I liked the program although at times it became a little boring. I learned, I think, a little more than I would have in the book. I think there should be a little more repeating to learn it in but not too much to get boring (mostly on the harder things). (sic)

I liked the program very much. One good thing is it did not ever get boring. From the day I started it has been interesting and exciting. I have learned a lot about algebra from this program.

My only criticism would be that at the beginning of the year they told us to take our time and don't worry about keeping up with your neighbor. Now I am way behind and I am never going to get finished. I think that the things I learned, I learned well, however.

I felt that it was sometimes very boring with no class discussion, and doing the same thing day after day. I liked it because we could work at our own speed, and not have so much homework. I liked it when we went to the board, because it helped to make a little variation.

I liked it for the reason that there was no homework to do. At times I felt I was left-up in the air when we had to stop at the end of a class period and didn't have time to finish. It was good in the reason that it made me work at my own speed.

I feel that at times the course gets somewhat boring. And I don't feel that the test questions throughout the unit, because I think they break a study mood. (sic) Otherwise I think it's a very good course.

The course at times became quite tiresome. You could work on your own time. No pressures for tests.

I feel it helps you learn algebra easier than the book does because you can take it step by step, but there should be something that takes the boring part out of it.

APPENDIX A (continued)

I liked working at your own speed. I don't feel there was enough repetition to make you remember. They don't give you enough different types of the same problem. It takes them too long to tell you anything. Like for 50 squares you use a minus sign then they tell you not to.

I think you learn a lot more from this program. I don't think they should have to be at a certain unit at the end of the year.

One dislike of this program is that it got a little boring at time because of very few discussion periods. Although I believe I learned more from this course with the machines, than I would have out of a text book.

I thought that this program was quite good for people who hate the classroom everyday and doing practically the same thing everyday. I think I learned more with this kind of program. If I would have been in a regular class I would have been bored everyday because I like to keep going and not keep repeating until everyone in the room finished learning or grabbing on to the facts before proceeding. It also kept your interest about 75% more than if you had to work from books. Somethings I didn't like about it was the reviews at the end of each unit. I figure if you are to learn it really good, you should remember what was in the last unit. (sic)

The main complaint that I have is that this course can get very boring. In teaching I think a lot of interest and inspiration is brought on by a teacher's personality. In this course all this is lost. Our class had blackboard and discussion periods which helped this and were a lot of fun. I had trouble in forgetting all the various operation and mathematical terms--maybe it would help if there was a handbook we could use where we could glance over these when we forgot--of course, I suppose could be a crutch, too. I don't know. I like the part on quadratics--I soon forgot how to factor polynomials, maybe it was my fault--the trig. unit and graphing unit were excellent and fun. Long units aren't, tho'. This course was easy--no homework--reg. algebra students had so much--I'm glad I took this. (sic)

The thing I disliked the most about this program was that it would give you the answer but it wasn't explained well enough.

I think this is a good way to teach algebra because I could go at my own speed and I learned more quickly by the method they used. I do think that there should be book accompaniment if the student <u>needs</u> it. But this should be used <u>only</u> when the students <u>doesn't</u> understand the things in

APPENDIX A (continued)

the unit. Also I think that there should be a limit to review time. At the beginning of the year, a goal should be set and charts made as to how far a student is to go during the year. Each student should make one according to his capabilities and should follow it closely so he will finish the course with the right amount of knowledge gained. Time is tended to be lost if you can do and go at your own speed.

You must learn to budget your time and work steadily. I think you learn more parts and more of one different type of problem. I liked to, however, because it kept you independent. I felt in some areas the course was too repetitious for me, however, it must be needed for some students who did not understand this area. An example of this was in the field of quadratics. (sic)

It took too many steps to show you how to work a problem, so that would (sic) forget something about solving it. If you go at your own rate you may not finish and therefore miss some valuable information.

I think the program is a very good one for those that can understand quickly a problem. I have gotten straight A's in the book style. I don't know if I can't think out the course fully and get right answers or what. I think that the program is for those who can readily adapt to this kind of work. I myself do not think I am doing this.

I feel more initiative is neededd throughout the year. I didn't have any ambition for getting anywhere because we were told to work slowly. I worked slowly and things dragged and got dull and I stopped concentrating. But now, when we are behind and must push and hurry, I'm enjoying the course and getting a lot more out of it. I feel speed makes the difference.

I liked the program because I could work at my own speed. I think if we were kept track of more at the beginning of the year, we could have gotten done with more of the unit. When I began to slow down I didn't know it and I wasn't warned about it at the first of the year so I got behind.

Of course, I liked the element of no homework. I believe I enjoyed this course more than I would have a textbook, and learned as much with the least time and energy. One thing I found annoying, however, was the fact that you never knew what you were trying to do, until you could do it, and then they would tell you what you were doing.

I think that the program is good because it starts on a idea and takes it

APPENDIX A (continued)

step by step and then repeats it again. Also you know right away if the problem is wrong or right. (sic)

This program was very easy to understand. I only had with one unit and that was unit six. (sic) In my opinion, the unit might have been broken down into say two units. And, too, there was not a noticeable break between the different types of problems and how to solve them. One major criticism is that this course is so boring. The first and second quarters weren't too bad, nor was the last one. But the third quarter can become terribly boring. (sic)

I enjoyed the experience, but I feel that by the end of the year the program becomes dull and tiring. I didn't feel that I got as much learning from the course as I should have.

APPENDIX B

TENTH GRADE STUDENT RESPONSES TO QUESTION SIX OF THE STUDENT EVALUATION FORM

I believe that this program did not help me too much. I think I would of got a much better grade in regular algebra. (sic) If there wasn't so much repeating and going over the same thing I would have liked it better.

This course towards the end was boring and I slowed down in the work I did. I think the books are a little bit better to study from. They discussed things from day to day in a regular class (books) where in here you would forget some of the things you learned.

I liked going at your own speed. It got a little boring sometimes. I didn't like the test over Box I.

I think the program is a good thing, but it got so boring for me, doing the same thing day after day. It was difficult not to day dream. I liked this program because it was easy to learn from, and tests were general. Kids that have regular classes think algebra is difficult, but I found it quite easy. I think more should be done to ease boredom, but there is no way of knowing if I would have been just as bored in a regular class or not.

I feel that the course taught me a great deal, not only of algebra, but also of the responsibility of working on my own and getting it done. The course also gave me a broader and clearer understanding of basic principles of mathematics that never seemed to soak in. I enjoyed the course very much.

I did not like this program because I didn't learn much from it. I would have rather had books. I don't like the idea of teaching ourselves because that's why we have teachers.

I learned very much from this course. I like the way it explained things in detail, and the way it took each course following the other. It was a very easy way to follow it, and I learned much. The tests at the end of every chapter were very helpful for the end of the test. It covered everything the book did, maybe a little better.

It stunk. (sic)

APPENDIX B (continued)

I didn't like it because some days I couldn't concentrate. Once you get behind it is difficult to get caught up. I think there should have been some homework or review sheets. I found that it was easy to forget some parts of the unit. If I was going to take a program like this again I wouldn't want it seventh period. It took me awhile to get used to studying by machines. I think if I took another course like it I could do better.

I thought that this course has helped me some but I think I could have learned more if I was in the regular class where you had to do homework. In this class you could cheat yourself by just running through the question and paying no attention whatsoever to what you were doing. In the class where I was this year, you could fool around too much, and waste time. I think it would have been better if I would have been placed in the regular class where you can't get away from homework.

I thought the program was boring and I didn't learn a thing. I could have learned more from a book instead of the program. I will never take a course again with a program.

I thought this problem to an extent has its advantages over the textbook method but I feel the machine algebra should be given to those who can read quite well and understand what they're reading. They should be given a test before hand on how well they understand things by seeing them for the first time. I also feel I would have learned more by the textbook method, because you are given new problems and explained how to work thoroughly and this way you get a thorough understanding and you will remember it longer. (sic) It also would be more interesting.

I thought I could have learned more from the book but the course was okay. It was easy to day dream and etc. (sic)

I think a person would do better using a regular textbook. With the program a person can go at his own speed, but he can go way too slow, therefore, getting nowhere in the course. In this course, there was no homework. A person forgets from day to day what he has learned unless he drills on it all of the time. I think, personally, that regular textbooks and having homework assignments work better. I think that the student learns and remembers more from the course by using textbooks and have homework assignments.

I liked the idea of working at your own speed. I disliked the way the machines would only go forward and not backwards as well.

APPENDIX B (continued)

The program let you move somewhat at your own pace which I felt was very helpful. A machine however, will never replace a teacher completely.

I did like for the reason I don't think I learned very much from. (sic) We had to keep going over and over a unit until we pass and these got very boring.

I did not like the program because by the time I was through and was ready for a test I had forgotten most of it, especially the ones that were real long. I get more understanding from a textbook and in the program it was too easy to get the answers from the problem.

I liked the program except I couldn't understand enough. If I would have been allowed to study at home with my units once in awhile on the hard ones I think I would have been able to understand what I was doing much more. (sic) Frankly I would have preferred having a textbook.

I did not like the program because it was so boring. I feel that I would have learned more from a textbook. Although it would be a very easy way of learning if it weren't so boring. Another thing, I disliked was that it was easily forgotten and that would make you fail tests, etc. (sic) But I know it would be a lot harder from a text and also a lot more studying.

I didn't like this program because it was too easy to get behind in, and it was boring.

I disliked the program because it was too boring when I go to class. I like to have some homework and not do it all in class, but there were some things I did like about the course. I could go at the pace I wanted to go.

There isn't much that I like about this program. I feel that with the textbook, a person can learn much more than with a machine. I feel that the program does not explain clearly enough, how to solve problems. With a textbook there is homework that keeps you thinking about the course, but with the machines a person tends to forget about what was covered.

I liked the way many of the problems in the frames where (sic) stated. I didn't like the methods which were used to explain rules. I used an algebra book sometimes and the rules were arranged in boxes and after each step there were examples. I did enjoy taking this course, but it

APPENDIX B (continued)

can be improved quite a bit. Another which happened while I took the (sic) course was the machine I used. The rollers wind about every 30 pages making it a nuisence (sic) to refix it. I am sure that some improving can be done to the machines, too.

I didn't like the program. I don't think I learned as much as I would with a textbook. Things didn't seem to be explained well enough. It was too easy to let yourself get by without learning.

APPENDIX C

NINTH GRADE TEACHER - ANECDOTAL RECORD BOOK

9/19/63 The majority of students are now finishing the first unit test. Three days this year were used for testing and two days for the ITED plus the first week for orientation has taken up most of the time until this week.

9/20/63 Everyone has finished Unit One so we took about half of the class period to discuss all areas of Unit One. The students came up with many questions. Was very profitable.

9/23/63 (_____) will be out about three weeks (in hospital).

9/24/63 (_____) seems to have a little trouble with the course. It is my opinion that he has a hard time initiating work on his part. Will watch him.

9/26/63 (_____) (who wanted to drop the course the first day) is writing perfect tests. At least the first three are. She wanted to drop as she thought she would get bored with the course. She may yet.

9/27/63 We took a major portion of the class period to discuss Unit Two. The students do notneed very much help on the early units, nor do they have many questions on Unit Two.

10/4/63 Took part of the period to discuss the content of Unit Three (Simple Equations). Discussed the "fundamental order of operations" as compared with solving simple equations. Sent (_____) machine home so that he can work on it while recuperating.

10/9/63 Some students are starting to question me about getting extra problems to work. I have set up a library of algebra books which may be checked out. Some students want to work a little at home. (_____) is an extremely nervous boy--don't know why.

10/14/63 (_____) took test (Unit Four) and asked to take the test again. They (the students) are not required to take the test unless they miss four or more questions. (_____) asked to do this on her own. This will not affect her grade any if she does better on this test.

10/15/63 (_____) did poorly on Unit Six test. On his own volition he asked for a textbook to take home to study.

APPENDIX C (continued)

10/16/63 (_____) returned the textbook this morning. He asked to take Unit Six over and got nine out of ten. (On the first try he got four out of ten.)

10/17/63 Took part of the period to discuss Unit Four; especially on removing parentheses preceded by a "+" or a "-" sign.
In making a student repeat a unit test it might be well to require that they must study the unit one full period or more before repeating the test.

10/21/63 Today the class shows the first sign (as a class) of being a little edgy. It seems the first inkling of boredom is setting in.

10/22/63 Out of 26 students:

1 has finished Unit 8
1 has finished Unit 7
7 have finished Unit 6
13 have finished Unit 5
3 have finished Unit 4

One student has been absent for four weeks and has his machine at home working.

10/23/63 (_____) (the boy that has been out for four weeks) came back today. He is in the middle of Unit Five. I have tests to give him on Units Two - Five but will give him some time to review these before requiring him to take the tests.

10/24/63 (_____) transferred to this class from second period conventional algebra. He was doing failing work and it was thought that he would have a better chance in this course. (He shouldn't be taking algebra at all.) He will not be included in the statistical results of the class, however. It will be interesting to follow his development.

10/25/63 At the beginning of the period we discussed all the rules of signs of the four operations. Some students were having difficulty understanding the program's presentation of signed numbers.

10/28/63 (_____) is finished with Unit 10 in Box I. There are only 11 units so she is well advanced in the course. The end of the first nine weeks period (really ten weeks) does not come for two weeks.

APPENDIX C (continued)

10/30/63 Out of 26 students:

1 is working on Unit 11
4 are working on Unit 9
8 are working on Unit 8
3 are working on Unit 7
9 are working on Unit 6
1 is working on Unit 5

11/4/63 (_____) wrote the final today on Box I. She did reasonably well on the test, however, if I can get her to slow down she may do even better. Four more students are almost thru' Box I. It looks, at this time, that quite a few will be done before the end of the year. Must develop more enrichment programs.

11/5/63 The end of this week is the end of the first ten weeks of school (our first quarter really). I can notice the difference between this class and the one last year in that these students had heard about the course and approached it more calmly. Also they volunteered for the course this year.

11/7/63 The fact that the students picked for this course had volunteered, to me, makes the class this year better than last years. They have advanced much faster and seemed to be grouped better. By grouped I mean they seem to be traveling together through the program. This may change greatly when they get to the next box.

11/8/63 Out of 26 students:

1 is working on Unit 2 Box 2
1 is working on Unit 1 Box 2
6 are working on Unit 10 Box 1
8 are working on Unit 9 Box 1
2 are working on Unit 8 Box 1
5 are working on Unit 7 Box 1
3 are working on Unit 6 Box 1

11/13/63 I have one student that I can't slow down. The reason I want to slow him down is that he has had to repeat four of the first 11 units for low test grades. He seems to be mesmerized by the program - keeps at full steam but retains very little the first time through a unit.

11/18/63 Used half the period to discuss factors, "simplify", and types of factoring. The majority of students have had factors and, of course, the word "simplify". It's odd that the meaning of this word is so hazy with

APPENDIX C (continued)

students in math. We had quite a discussion on it.

11/19/63 Out of 26 students:

1 is in Box 2 Unit 3
1 is in Box 2 Unit 2
1 is in Box 2 Unit 1
11 are in Box 1 Unit 11
7 are in Box 1 Unit 9
3 are in Box 1 Unit 8
2 are in Box 1 Unit 7

11/20/63 I had to stop a little discussion between two students over a test. One had taken it and the other had not. Had a talk with one boy and I think it's cleared up.

11/27/63 I was absent this day. The substitute teacher apparently had no trouble in handling the class. No tests were given on this day, however, as I asked the substitute not to give any.

12/3/63 There are ten students studying for the final over Box 1. Compared to last year these students are putting in a lot of time reviewing for this test. Either the word is out that the test is tough, or these students are more concerned than last year.

This group is much more bunched than last year also.

12/6/63 One student has studied for five days in preparation for the test over Box 1. He is not "goofing" off.

12/11/63 Out of 26 students:

Box II	Box I
1 in Unit 4	6 in Unit 11
3 in Unit 3	5 in Unit 9
1 in Unit 2	
10 in Unit 1	

Still fairly well bunched.

12/18/63 Took an entire period off and discussed four types of factoring and the reverse process of multiplying. Following this quadratic equations were discussed. The program is very weak in discussing factoring and quadratic equations (that is in Box I). I realize Box II has a unit on quadratics also.

APPENDIX C (continued)

12/19/63 Out of 26 students:

Box II	Box I
1 in Unit 5	10 in Unit 11
2 in Unit 4	1 in Unit 9
4 in Unit 3	
6 in Unit 2	
2 in Unit 1	

1/2/64 One student, (_____), is transferring out of town. He will go to a small town in South Dakota. I am sending a little resume of his work along with his transcript.

1/6/64 I have one student, (_____), that had repeated every test since Unit 5 - Box I. She is now in Unit 9 - Box I. To progress this far has taken elevdn weeks. In Units 6 and 9 she took the test three times. I've been giving her work in a textbook as outside work. This has helped some but I think this person just can't study by herself. She tries hard but reading or something is holding her back.

1/8/64 Out of 25 students:

Box II	Box I
1 in Unit 6	5 in Unit 11
1 in Unit 5	
2 in Unit 4	
10 in Unit 3	
1 in Unit 2	
5 in Unit 1	

1/9/64 I can detect quite a bit of boredom setting in at this point with some of the students. Most of them have started the second box which is considerably larger than the first. Maybe they see only a lot more of the very same thing.

1/16/64 Another student, (_____), is moving out of the state. This makes two so fer this year dropped from this course.

It would be interesting to contact the two students later and see how their transition came out from programmed instruction to conventional textbooks.

1/20/64 Transferred a boy, (_____), from a regular class to the machines course. The reason is that he has missed 26 days out of 38 days of the quarter for illness. He's a good student but is ill a lot. I'm going to test him with the program tests to see about where he should be. This may prove

APPENDIX C (continued)

to be a valuable way to help a student who has missed considerable school and where make-up work for such a long time becomes nearly insurmountable. We'll see how he progresses.

1/21/64 Started with the test for (_____) today. I think he'll be able to bypass many units and catch up. We'll see.

1/22/64 (_____) wrote passing tests on the first four units of the program in one day. He missed a few questions in Unit 5 so I'm having him go through that unit today to clear up any cloudy areas.

1/29/64 (_____) has worked his way through Unit 8 so far in about a week and a half. Remember he has had the first semester of algebra by regular textbook and that this student is above average in ability.

The spread of the students is as follows: (25 students)

Box II	Box I
1 in Unit 7	1 in Unit 9
2 in Unit 6	1 in Unit 8
2 in Unit 5	
6 in Unit 4	
5 in Unit 3	
3 in Unit 2	
4 in Unit 1	

1/31/64 Found one student reading a book in class today. She is apparently quite bored with the program. When questioned she claimed she would rather be in a conventional textbook course. She went from a B to a C from the first nine weeks to the second nine weeks. Maybe this shows her lack of interest. I think her ability is above average but I haven't checked her math aptitude scores.

2/3/64 Another case of boredom has shown up. This student, (_____), was doing some unicursal drawings I had posted on the bulletin board. (Figures to draw without lifting the pencil from the paper.) This probably would be a good diversion for all the students at some time.

2/4/64 It's interesting to note how students are reacting to this type of course. Most students having finished a unit, immediately take the unit out of the machine and review it. Some take a period, some two periods. This they have learned without being told. They have developed some sort of iniative or motivation to study for a test. Many students in conventional algebra do not do this -- even when told to do it.

APPENDIX C (continued)

2/11/64 The boy that transferred in from conventional algebra, (_____), because he had missed 26 days out of 38 in the second quarter is now starting the pattern all over again. He has missed eight out of the first 17 days of this quarter. Illness seems to be the cause. He was doing well, too.

1/12/64 Found one student "apparently" helping another student during a test. Not conclusive evidence but he was holding the test questions in the seat behind her while she was writing. She is a "D" student and he's fast getting to be a "D" student. "The blind leading the blind."

2/17/64 The last two students are finishing the first box today. Then everyone will be in Box II. There is one student that was transferred in later that is behind but he is not being included in the total group.

2/19/64 On February 14th I sent a set of programmed algebra home to (_____). (The boy that has been absent so much.) His illness keeps him home but he is able to work. His mother wants him to try to keep up in his subject areas, if possible, at home.

2/21/64 There seem to be some students in this course that feel that they aren't getting a complete course in algebra. As a result students are checking out books and studying on their own. They study problems that give them a broader coverage - such as infactoring.

2/26/64 Out of 25 students:

Box II	Box I
1 in Unit 11	1 in Unit 11
0 in Unit 10	
1 in Unit 9	
0 in Unit 8	
1 in Unit 7	
7 in Unit 6	
5 in Unit 5	
3 in Unit 4	
4 in Unit 3	
2 in Unit 2	

3/3/64 The student that was absent so much the second quarter, (_____), has been absent all but nine days so far this quarter. I sent the machine home last Saturday. He has had the program at home for many weeks. Haven't been able to give him any tests yet since Unit 8, Box I.

APPENDIX C (continued)

3/12/64 The students are now getting into fractions, radicals, etc., and as a result they are slowing down considerably. Some of the better students have to repeat tests. I'm not sure whether it's the weakness of the program or if they go too fast from previous, easier units.

3/13/64 Sent the students to the board today. Worked on factoring, quadratic equations, and into some forms of radicals. Students again were very receptive and enjoyed a day "that was different". I think they learned something too, according to the type of questions they asked.

3/23/64 It won't be too long before (_____) will be finished with the course. She has two units plus Unit 15 (which is review) to finish. She has indicated an interest in Sets, so I plan to use "Worktext in Modern Mathematics" as her text. This is organized pretty much on the basis of self-study. It will be interesting to see how she does with it. I'll be able to give her plenty of help.

3/24/64 (_____), the boy who was absent so much, died. I think that he was showing the fact that a good student can use a course like this to "catch up" when behind for various reasons.

4/1/64 Everyone has definitely slowed down. I'm not sure if it's due to the type of work, or if it's due to students becoming tired of this type of course.

4/7/64 25 students are located in the following Units:

Box II
1 in Unit 14
1 in Unit 12
2 in Unit 10
3 in Unit 8
3 in Unit 7
6 in Unit 6
3 in Unit 5
1 in Unit 4
2 in Unit 3
1 in Unit 1 (not in program count)

4/15/64 Some of the students feel that they are a little behind for the year (seven weeks left) and they are coming in during their free periods to work on the program. One girl is on the last unit and will finish this week, I think.

APPENDIX C (continued)

4/28/64 Some of the students seem to work much slower this year than before. As a group we seem to be behind last year's group at this time. Perhaps I gave them the idea that they had too much time for the course. Anyway, I am having them put in extra time on the course during their study halls.

4/29/64 25 students are located in the following units:

One finished
1 in Unit 14
2 in Unit 11
3 in Unit 10
2 in Unit 9
6 in Unit 8
3 in Unit 7
4 in Unit 6
2 in Unit 4
1 in Unit 3

5/7/64 The first student finished the course today with the final exam. She is now working on "Introduction to Sets". Excellent student!

5/12/64 This year the students were allowed to work on a unit until they felt they had mastered it. They also were allowed to review as long as they saw fit. As a result they are behind last year's class although they are grouped better. Some will have trouble finishing the course.

5/18/64 Another reason this class is behind last year's, is that they are required to repeat a test until they pass it by 70%. In some cases they rewrote the tests three times.

5/26/64 It is a mistake to let the students progress entirely at their own rate of speed. This year I let them do that and many of them did not complete the course. One must set up some sort of a time schedule.

APPENDIX D

TENTH GRADE TEACHER - ANECDOTAL RECORD BOOK

9/9/63 We did problems 1 - 9 together last week so everyone started on problem 9, Unit 1. (_____) finished Unit 1 in one day. Quite a bit of machine trouble (jamming), some caused by pages being wrinkled by previous users.

9/10/63 Much testing activity for Unit 1 (Post Test) and Unit 2 (Pre Test). Much less trouble with machines.

9/11/63 Gave Lankton Algebra Test.

9/12/64 All students have now finished Unit 1. (_____) has finished Unit 2. She also discovered that the Post and Pre tests have the same questions. Very little machine trouble today.

9/13/63 Entering today is a new student, (_____). He started on the machines today but will be given the Pre Tests Monday. Four more people finished Unit 2. (_____) asked if the machines would be used all year. She seemed not too happy that they would. Others seem to accept machines with more enthusiasm.

9/16/63 Ten more people finished Unit 2. Two of these, after taking the test, were made to take it over because they had below 60% on the Post Test. (_____) has also had to take Unit 1 over. The two people who are taking Unit 2 over are (_____) and (_____).

9/17/63 Mechanical problems have been decreased to none. Last ten minutes today were spent in reviewing how to enter items in student logs.

9/18/63 A few of the students have discovered that the pre tests are identical to the post tests for each unit. Hence, I have had to take the pre tests they had worked away from them after they have studied their mistakes.

APPENDIX D (continued)

9/19/63 When asked how they liked the machines most students responded favorably. Many like the idea of no homework. Only one person, (_____), expressed boredom and would prefer conventional methods.

9/20/63 Much of my job now, I feel, is answering questions regarding the subject matter, not helping unjam the machines. More students are asking questions regarding the problems, which I feel is conducive to better learning.

9/23/63 Today some students were concerned as to how they would be graded for the course. It was explained that much of the grade would be based on accuracy on the Post Tests and that some would be based on where they were in the course, based on speed.

9/24/63 It seems that more people are not passing the tests and hence must take the unit over again. To be able to go on to the next unit a student should get above a score of six out of ten. Some are not doing this and have had to take each unit over again.

9/25/63 A few days ago the students were told they could have access to a textbook if they desired. So far two people have requested the text and one of those, (_____), took the text home over night. He said it helped clear up some material on solving equations such as $3x=21$ and $\frac{3}{7}x=21$.

9/26/63 Some students were doing too much talking and not enough working, so the seating of (_____) and (_____) was changed. (_____) was also involved. These three students are also the slowest in the group, (_____) being only on Unit 3.

9/30/63 A very quiet day. Only two people taking tests. No machine trouble. A few students asked about problems in the subject matter. New student entered from California today, (_____).

10/1/63 I have noticed that the speed of the students finishing units has decreased quite rapidly. This is probably a result of the subject matter becoming more difficult. I have also noted more questions regarding the exercises in the program.

10/2/63 I have noticed that some students have been reviewing their material in the units. To give equal opportunity to others, I announced that anyone could review the frames, especially those they missed before taking the post test.

APPENDIX D (continued)

10/3/63 New student, (_____), entered today. (_____) changed from experimental to control group.

10/4/63 (_____) finished testing program and started working on her machine. She was quite confused at first, but seemed more confident toward the end of the period. She is starting quite late, but I had her start at the beginning anyway.

10/7/63 Very quiet day. Some people are doing Unit 5 for the third time. I believe I'll not have them do it again if they do not pass the test the third time.

10/8/63 (_____) has finally got through Unit 4 for the third time and passed it with a 70%. I keep telling the student to remember what is in the frames and to study the subject matter, but some people just go from one frame to the next and see no connection between them.

10/9/63 Four people have checked out textbooks to study over the long SDEA weekend. Some students have used them quite regularly and others should use them more.

10/14/63 A new student, (_____), entered today from California. I did not put him through the testing routine, because I no longer had the materials and he was now so far behind that I felt he could not take the time. He is supposedly a slow student and was in general math in California, but preferred to take algebra.

10/15/63 The machine teaching is very handy for people who are absent. A student had been absent for two weeks and could simply start out where he quit the last day of his attendance.

10/15/63 I made a check of the student logs today to see if they correspond with my grade book. All but one was up to date.

10/17/63 Students have been wondering about their six weeks grades because of low percentages on Unit Tests. I ran a scale as follows:

A -	100 - 90	
B -	80 - 89	Minus and plus were given for speed.
C -	70 - 79	The scale gave only one F, one A and
D -	60 - 69	a majority of C's.
F -	60 and below	

APPENDIX D (continued)

10/18/63 (_____) has already finished Unit 9 on the first box and has been passing all his tests very well. (_____) has also finished Unit 9, but failed the test so must take it over. Unit 6 seems to be giving most students trouble.

10/21/63 (_____), who has been absent for two and one half weeks, was found to have been skipping this class, being the last period of the day. After he was found out, he had a twisted knee (according to his excuse). He may have been afraid to show up. He is back today and when asked why he skipped, he had no reason. He has been out of school for the past two years.

10/22/63 I have been going over the post tests of those students who had below 70% and showing them where their mistakes have been made. It has shown that it helps when they take the test over, although I'm not so sure that they don't simply remember the answers. This helps the slower students to not be required to take a unit over more than twice.

10/23/63 At the PTA last night, some parents were concerned about the program. Comments such as, "Are they learning any algebra?" and "Is this a better way to learn?" were raised. (_____) parents said he was very enthusiastic about the program. He is also doing very well.

10/24/63 (_____) could have finished Box 1 today, but failed the test over Chapter 11. It is the first test he has had below a 70%. I told him he must have been over anxious to be first to finish Box 1 and he agreed. He's taking Unit 11 again and should still be the first to finish. Many students are still having trouble with Unit 6.

10/25/63 Many students troubles on Units 5 and 6 are that they do not do the same things to both sides of an equation. Their next step in a problem such as $\frac{x}{2} + 3 = 6$ would be $x + 6 = 6$. Unit 6 is still giving trouble. Short period today due to pep meeting.

10/28/63 (_____) has finished the First Course, having passed the post test on Unit 11 on the first try. She will take the course post test tomorrow, or if she wishes to review, I'll give her time to do so.

10/29/63 A very quiet day. Students worked very well by themselves and very few tests were given. (_____) took the First Course post test and had 80%. (_____) also took Unit 11 post test again and passed with a 70%.

APPENDIX D (continued)

10/30/63 Much more confusion today. Many students were taking tests and so had to walk up to get the test papers. (_____), finished Course I, post test and made 75%. He and (_____) are starting on Course II.

10/31/63 I have noticed that the subject matter of the experimental class is much more advanced compared to that of the control group. The control group is solving simple equations such as $3a + 8 = 5a - 16$, but the experimental group is already introduced to quadratics. (Many of the students are on Unit 11 where this is introduced.

11/1/63 There seem to be quite a few questions on factoring quadratic trinomials. In factoring $x^2 - 6x + 9$ many students have the work and answers $-3 + -3$, but not in the form $(x-3)(x-3)$ on their Unit 9 tests.

11/4/63 There seem to be quite a few questions on problems which use the concept of $x - (y-z) = x-y+z$. Also, many errors are made on tests in problems using this idea. It seems the program has some weakness in the explanation of this.

11/5/63 (_____) took the post test for Course I and had a 60%, so I gave her a folder with all the unit tests and answers and told her to review those and take the course post test again. I will do this with all students who have less than 70% on this test.

11/6/63 The window on (_____) machine is very dirty from pencils, ball-point pen, and eraser marks. He asked me to clean it. I will try alcohol on it tonight.

11/7/63 Some time is being wasted by some students in arranging the sheets in chronological order. One student dropped a unit as he took it out of the box and sheets were all mixed and out of order. Another student thought his were out of order because the top frame on one page read 251 and the top frame of the next page 256. He did not realize that there are five frames on each page. Also some units, I think, are mixed from last year. There are also a few pages missing.

11/8/63 Today two more people took the course post test and did very poorly (30 - 38%). I had them review through a folder of post and pre unit tests, and will have them take the course post test again. Students on the second course are doing better than they have on the course unit post tests, although those finished with Course I are the sharper students.

APPENDIX D (continued)

11/12/63 (_____), a student who is behind and a slow worker, has asked if he can stay after school and work. I said he could so he is coming in tomorrow afternoon after school.

11/13/63 For some students who fail their Unit Post Tests, I have been going over the test with them. This seems to help very much on the next time they take the test. This may be because they memorize answers, but I don't think so in many cases.

11/14/63 Students have asked if they must take this course second semester. Some have said they liked to stay with it (the students doing better) and others would like to get out of this group. (_____) still says she "hates" this method of learning. She says she relies too much on the answers.

11/18/63 A very quiet day today. (_____) took Course I Post Test and did not get above 70% so is taking it again after reviewing all old pre and post tests for the units and using the answers.

11/19/63 Several students are having trouble on post test Unit 11 on problems such as $x^2 + 8x = 0$. They do not even attempt the problems because they do not know what to do. Apparently there was not enough emphasis on factoring the non zero side and setting <u>each factor</u> equal to zero separately.

11/20/63 I have some students who like to day-dream and who must be told to "get busy" quite often. I feel that because people are encouraged to work at their own speed, some students do not work to the best of their ability. Some boys must be constantly reminded.

11/21/63 Some of the programs were put away last year in not very good order. One student had duplicates of about half of Unit 11, so I suppose some other box is missing those pages. Many units have pages out of order and some have one or two pages missing. Possibly some pages were too badly mutilated to be used again. This year I am checking each program before it is put away.

11/26/63 A new student, (_____), a senior who wishes to take nurses training and found she needed algebra, was admitted to class Friday, November 22nd. She is taking the machine home on weekends and last weekend she completed Units 1 and 2. Today she took the Post Tests and passes both with 70%. She is a 12:00 o'clock dismissal student so will not come every day, only when she needs to take a test. At first she will take two units at a time.

APPENDIX D (continued)

12/2/63 I discovered that (_____) was keeping a copy of the questions on Pre tests and thus doing the unit very rapidly (one or two days) and passing the test. I'll have to watch him take a test after this. I believe that the fact that the pre and post tests are identical is a disadvantage for this reason. If a student catches on to this fact he can do quite well.

12/3/63 I asked for a show of hands today as to how many people were on Course II. There are already ten students on the second course and some are quite far into it. (_____) just made a 100% on Test for Unit 4. Students have been doing better on my own tests made out for Course II. (_____) is also on Unit 5 and several others are on Unit 4 of Course II.

12/4/63 (_____) stayed after school today for an extra hour of work. I have told all students they should be through Course I at the end of this semester. She is on Unit 8 now. She has also recorded the extra period in her student log as all people who take extra periods do.

12/6/63 A very quiet day today. Period was shortened due to pep meet after school. Very few people took post tests. (_____) finally passed his post test on Unit 9. He is not doing nearly so well after I caught him with a copy of the test questions and have been watching him more closely.

12/9/63 Last evening (_____) father called and wanted to know why his son was failing algebra. I told him that (_____) was not doing work (he's farthest behind in the class) and that he was making trouble in class. I also told him that two people in the class had asked to have him moved away from their vicinity in the classroom. I have called him down several times and suggested to the father he do the same. He is working like a gentleman today.

12/10/63 (_____) finally succeeded on Post Test Unit 6 today on the fourth try. He is now starting Unit 7 and is still the slowest in the class.

12/11/63 There seems to be quite a little trouble on the post test of Unit 11 on problems that read "solve for x". Many students simply factor the non-zero side of the equation and think that is solving for x. Evidently this was not explained too well that solving x means x = some number.

12/12/63 At the teacher's meeting on pre-registration for second semester, it was announced that all teachers must register their homeroom students to the experimental groups next semester if they were in it this semester. A list of these people was given to all teachers. Attempt has also been made to get the same people in the control groups for both semesters, but the

APPENDIX D (continued)

period had to be changed, which will probably cause some problem. I will make a follow-up study on those people who do not get into my control group next semester.

12/13/63 (_____), the student who skipped out of this class earlier this year, came back today after a four week absence. He was considered a permanent drop-out but evidently was let back in school. I wonder how often he'll be in and out of school this year.

12/17/63 There seems to be an unusual number of mechanical difficulties today. Sheets are rolling around the bottom rollers on several machines.

12/18/63 (_____) is in again today to take Unit Post Tests 7 and 8. She is on an arrangement whereby she comes in after finishing two units and takes both tests. So far this has worked very well. She is catching up very rapidly and hasn't had to take a unit test over as yet.

12/19/63 (_____) has been sitting in my control group during their class sixth period and working on the machine (catching up for all the time he missed). So far this has worked quite well, as he has passed two units since he returned. This is a real advantage of the machine method. I am wondering if the machine method might be better if a longer block of time could be spent on the machines each day. (_____) and (_____) are both spending more time each day on the program and both are doing much better than the average on the post tests. Spending only one hour per day, students might forget the first part of a unit when he finally takes the post test.

1/2/64 A very quiet day today. I suppose most students were reviewing their knowledge of the units before taking a chance on a test. Only one unit test given today. All classes were quite dull today as it was the first day after vacation.

1/6/64 I told students today that they should be through Course I by the end of the semester. Most students will make it (many are finished already) but some will not. However, it made everyone work very well today and more people took tests today than have for some time.

1/8/64 Many students took tests today. More than the average day. This is probably due to my warning that a semester test would be given covering only all of Course I. This may have tended to rush some students because they have not been doing as well on tests lately. However, the students still on Course I are the slower students.

APPENDIX D (continued)

1/9/64 (_____) came in again today and took the post tests for Unit 9, Unit 11, and the entire Course I Post Test. She did very well on all the tests as she always does. The programmed course is a wonderful opportunity for a person in a situation like hers. (see note for 11/26/63)

1/13/64 I told students on Course II that they could review Course I today if they wished. I have made out the semester test to cover just Course I, although some students have still not finished it. I did this because they had been told very early this semester that they must finish Course I by the end of the semester. Tomorrow we will review orally. Several students are taking Unit 11 Post Test today.

1/21/64 We left the machines in the closet today and discussed the semester test. I believe this has really helped some people in certain areas. We did not quite finish, however.

1/22/64 We finished discussion of the semester test today and then reviewed some basic concepts. I wrote out rules for operation with signed numbers, quadratic formula, general quadratic equation, etc., for students to "memorize" and be able to use on a quiz Friday.

1/23/64 These concepts were quite weak in some students. Students are working on their machines again today for the first day of this semester. Many of them seemed rather lazy or tired and didn't want to work. Much daydreaming, which I had to warn against.

1/24/64 Today was the quiz over rules for operations with signed numbers. After the quiz I told students who felt they did poorly that they could use a textbook over the weekend and study Chapter 3. Only two persons called for them.

1/27/64 Two students were lost in the changing of semester, (_____), who transferred and (_____), who failed the first semester. All others are back this semester. Most students are now working on the second program, Course II.

1/31/64 I gave the quiz again today over the rules for using the operations on signed numbers. I found in the semester test that many students did not know how to work with them, so I gave them the set of rules from the text we are using in the control group. I feel the course is rather inadequate in this area.

2/3/64 (_____), the student who was cheating during the first semester

APPENDIX D (continued)

by failing the test, copying the questions and then taking the test over; is now in trouble. He is lacking all the background material from previous chapters and has now been taking the post test for Unit 11, Course I several times and makes about a 50% each time. I should have caught him sooner because now he is really behind.

2/5/64 Many students have problems on Unit 2, Course II in finding square roots from the table. The main problem lies in the fact that they cannot place the decimal. I almost invariably get the same answers for the test questions.

$\sqrt{.000081}$ = _____? and $\sqrt{.0000081}$ = _____?

Also, students do not realize that two digits in the radicand correspond to only one digit in the square root.

2/7/64 I have had a report from one of my geometry students that he had the programmed course last year. He has said that he did not learn as much as he feels he could have learned from a textbook. This is also my feeling as I don't believe that this course goes into a topic as thoroughly as the text. The problems in the text are also more difficult.

2/10/64 (_____), (see 2/3/64), has been doing much daydreaming and loafing in class, so I have finally had to require that he hand in his work tape at the end of each period. This may put a little pressure upon him. It seems to have worked so far, but he is having problems.

2/11/64 (_____) has just taken the post test on Unit 12, Course II and will start Unit 13 tomorrow. He is doing an excellent job on this course, passes every test, and works quite rapidly.

2/12/64 Two people, (_____) and (_____), finished Course I today by passing the Course Post Test. Most students are in Course II now except for a few.

2/14/64 (_____) is having trouble with division of polynominals. This seems to be a difficult concept with students as it gave trouble in the control group also. (_____) is having problems with simplifying radicals.

2/17/64 There are still three people on Course I. They are (_____), (_____), and (_____). The first two are on Unit 11 but have failed the test several times. (_____) is studying for his Course I Post Test, which he has failed. I think I'll have to let them go on after taking it again, regardless of the grade.

APPENDIX D (continued)

2/18/64 More and more students are doing progressively better work on the unit post tests for Course II. I don't know if my tests are easier than the tests made by the publishers or if material is being learned better. I have noticed many students reviewing the frames in the unit before taking a test. On this type of review, they do not use the machines, but use only the frame sheets, concentrating on items that gave the most trouble.

2/19/64 It seems as though the students are not using the textbooks as much as previously. In fact, today all the texts are in the closet on the shelf. Evidently the course program is explaining the material adequately at this point. Most students are on or near Units 3 and 4, Course II.

2/20/64 There were many varied problems today, such as torn pages, pages missing in the program, a page missing in the table of square roots and a machine jamming. Today seemed to be an exceptionally bad day for problems such as these. Some machines seem to have trouble with the rollers sliding over on the shaft. This causes jamming when the rollers are too far out of alignment.

2/24/64 A very quiet day today. I don't know if it is "blue Monday", or if it is algebra that is keeping things quiet. Very few questions and no machine trouble.

2/25/64 Two people took the post test for Course I yesterday and passed it, so are finally starting Course II. They were (_____) and (_____). (_____) and (_____) are still on Course I. (_____) has been absent so far this week.

2/26/64 In reading last year's report (1962-63), I find that most of the group this year is about the same place in the course as last year's group. However, I have a few stragglers. Perhaps this is because I have required a grade of seven out of ten on a unit post test before a student could proceed to the next unit. I understand last year the required grade was six out of ten. This is possibly a better requirement. I may have to drop my standards because these few students are behind due to this regulation.

2/27/64 A very busy day today. About half the class seemed to be taking tests today, so I was kept busy checking them.

3/4/64 A very discouraging day today. Four people took post tests and none of them passed. All must repeat the previous unit. I went over the tests with these people and showed them their mistakes. Tests taken were over Units 1, 3, 4, 5 of Box II.

APPENDIX D (continued)

3/5/64 I had a substitute this day because I was ill. Her comments were that it could be a very profitable way to work, if the students would work harder. She had a discipline problem with (_____) and (_____).

3/6/64 (_____) has taken the final test for the second course and had a 60%, so he is reviewing the last review unit. I made this final exam more difficult, since only the brighter students will get to take it.

3/9/64 (_____) took the final exam again and received a 70%. After he irons out his mistakes on the final, he will begin working in some booklets that deal with set problems. Officially he has finished the programmed course.

3/11/64 I have gained a new student, (_____), who transferred into our school and started in the traditional course. After finding he was behind, he was placed in this group. I started him on the second box, so that he is still behind the rest of this group. However, I see this as an advantage of the programmed instruction.

3/12/64 I think that I have lost a student, (_____). She received a failing grade for the last six weeks because she was still on the first box, due to constant absence from school. She hasn't been back since and I heard that she had to quit school.

3/13/64 This was a very busy day for me. Most of my other classes seemed quite restless and would not work very well. I assume the State B Tournament had some effect on this. However, this class worked very well and many students asked constructive questions. I believe they learned some algebra today.

3/16/64 (_____) is next in line for finishing the course. She took test 12 today and is now working on Unit 13. Most students are concentrated around Units 3-6.

3/18/64 I detected what I think was another attempt at cheating today. Yesterday (_____) took a Unit test and today (_____), (who sits just across the aisle) took the same test and made the same mistakes, in fact, his paper was identical to hers. In one problem she omitted the = sign in $ax + a^2 = a(x + ay)$ and he also omitted it. It appeared that he simply copied her paper. Both failed the test anyhow so both are taking the unit again.

APPENDIX D (continued)

3/19/64 One of the answer-mates gave trouble today so that I had to substitute another for it. It seems a key fell out and is now lost, causing the shaft to slip. The knob could be turned but the rollers would not turn.

3/20/64 There seem to be a few machines that are still rather persistent in jamming. There is nothing visibly wrong with them but the most trouble is caused by the sheets rolling up around the bottom rollers.

3/23/64 Three tests were taken today and all failed quite badly. Either the units are becoming more difficult or my tests are getting harder. The units are longer also so that may be a factor. It seems students are not concentrating as well as previously.

3/24/64 Some students are still having trouble with factoring, although they are suppose to have finished that unit. However, this is also the case in my control group and I suppose it is common in most algebra classes.

3/31/64 All students worked very well today. It seems there was good concentration for most students. This may be due to the fact that I told the class that they should be through Unit 6 at the end of this six weeks period.

4/2/64 A few students need to be reminded constantly to keep working. Some are inclined to daydream and waste time.

4/3/64 (_____) is having much difficulty on Unit 4. She is on her fourth time through it and has never received a grade above 55%. I have tried to help her, but she seems to get nothing from the unit. She cannot even add like terms.

4/6/64 The class was reminded today that they should be through Unit 6 by the end of this week. They were also told that they need only a grade of six out of ten to be allowed to progress to the next unit. Previously this was set at seven out of ten.

4/7/64 (_____) is tutoring a student who cannot attend school because she is crippled. He has been using the program and a machine and says it is working quite satisfactorily. A definite advantage for this type of material.

4/8/64 Our school had visitors from the Sioux City Schools here recently.

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They observed the machine class and were quite interested, asked many questions. They asked if the materials "went dead" for some students. This phrase is perfectly descriptive of a few students' work lately.

4/9/64 Since several people were having trouble on simplifying radicals, I called this group to a corner of the room and helped them. I believe that this was very worthwhile.

4/13/64 I have been trying to help those students who are behind in the program. I believe that some have been helped considerably. However, some will never get back on their feet. (_____) does not know enough about what is going on to be able to ask a question. He has failed quite consistently and doesn't seem to care. However, I have the same type of students in the control group.

4/14/64 For the past six weeks period, Unit 6 was the pre-determined minimum progress point. Most students reached this point. For those who did not, the six weeks grade was their daily averages (averaged with the entire class) minus one letter grade for each unit short of Unit 6.

4/16/64 Again a student found several pages of a unit missing from her box. Here is another case of a difficulty that could be avoided if the program were in a textbook form.

4/20/64 Many students requested help today - a good sign that most of them were really working.

4/21/64 A few students are putting in extra sessions after school since Unit 12 has been set as a minimum progress point for the end of the semester. There should be more students staying if they are to reach this point.

4/22/64 (_____) had a perfect paper on the trig test for Unit 15. All she has now is the final review unit and she will be finished with the program. She will be the second student to finish.

4/24/64 A few of the slower students are having trouble dividing polynomials. I have had to guide them almost completely through a few problems before they see the sequence of steps. However, once they get the procedure, there are plenty of problems they can work in frames. Plenty of practice on this type.

APPENDIX D (continued)

4/27/64 Not many students asked for help today. Either they are learning algebra or they are not working. All students seem busy, but some have been caught "faking it".

4/28/64 Seven students took unit tests today, a larger number than usual. One for Unit 3, one for Unit 4, one for Unit 6, two for Unit 8, one for Unit 9, and one for Unit 10. The first two students (Units 3 and 4) failed (below 60%) and all the others were allowed to progress to the next unit. This system puts slower students still farther behind, but I can't see any value in letting them progress when they cannot do the material they are studying.

4/29/64 Three people asked for help in proving the quadratic formula by completing the square. They have had numerical coefficient problems in completing the square before this sequence, but they cannot see what is to be done with literal coefficients. I realize this is a difficult subject; the control group will not even be introduced to this.

5/1/64 I do believe that boredom has set in today. I hope it does not last. This is Friday and the weather is balmy, which might be considered as contributing factors.

5/5/64 Several students working on tables for graphing (Unit 10) cannot solve simple equations such as $3x - 2x = 4x + 6$, or even one case where $2y = 9$ could not be solved. This type of problem could use a little more review, I feel, in the first part of Course II.

5/6/64 (_____) seems to have given up or quit working. He hasn't taken a test for four weeks and is still stuck on Unit 3. He does quite a bit of daydreaming and doesn't seem to care. I've constantly reminded him to get busy.

5/7/64 (_____) was the second person to finish the course, finishing today. She also was started working on sets in the Holt, Rinehart and Winston; Elementary Concepts of Sets by Woodward and Mr. Clellan.

5/11/64 No class was held on 5/8/64 due to a teacher's meeting. I have discovered today that some students have to look up in the textbooks how to factor quadratic equations in order to solve them. At this time they are supposed to know factoring, but I feel my control group know it better.

5/12/64 (_____) finished the supplementary booklet on sets (see 5/7/64) with a perfect test paper today. Next he will start on a booklet which

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approaches probability from the set idea.

5/13/64 I find that with the machines, students sometimes miss out on terminology, for example, students call x^3 "x - three" instead of "x - cubed". Also, their pronunciation is incorrect on some terms, although the program does show the terms with the pronunciation marks.

5/14/64 Most students are through Unit 6 now and progressing at a faster rate. I feel that Units 5 and 6 are too long, which provides a good opportunity for boredom and "giving up". Five unit tests were taken today over Units 14, 11, 10, 8, and 7.

5/19/64 I have complained some about these students in the experimental group getting lazy. However, I believe the control group is even worse. The machine taught students are striving toward Unit 12, which we have made a minimum requirement, whereas the control group is just "quitting".

5/26/64 The past few day have been spent in testing.